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Distribution and activity pattern of the Yellow bellied mud turtle *Pelusios castanoides intergularis* Bour 1983 on La Digue, Seychelles

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Abstract: The Yellow bellied mud turtle *Pelusios castanoides intergularis* Bour 1983 on La Digue was investigated within several excursions on the island in December 2004, 2007 and 2008. The main population is located at the Mare Soupape at the west side of the island, however, a second population was found to be present at the water bodies at Grand Anse (east side). On sunny days, activity was restricted to the morning and the late afternoon hours, whereas after rain falls turtles were also active at noon and early afternoon hours. In 2008, a relatively long dry season caused a dramatic decrease in water levels along the island, leading to almost all tributaries of the Mare Soupape drying out and remaining water bodies at Grand Anse were restricted to small areas by the end of the same year. Temporary dry periods will usually not affect freshwater populations on La Digue, however, the drop of water levels seen in the second half of 2008, lasting for longer time periods could result in an additional and permanent habitat loss.

Key words: habitat, distribution, biology, conservation.

Introduction

The central Seychelles islands are inhabited by two endemic subspecies of mud turtles, the Black mud turtle *Pelusios subniger parietalis* Bour 1983 and the Yellow bellied mud turtle *Pelusios castanoides intergularis* Bour 1983. The status of a third species, the Seychelles mud turtle *Pelusios sechellensis* Siebenrock 1906 once thought to live also on these islands remains unclear (it may be extinct: Bour 1983, 1984, Gerlach 2008a).

The populations of the two recent subspecies, especially on the increasingly urbanised main islands of Mahé, Praslin and La Digue decreased dramatically during the past decades mainly due to habitat destruction, fragmentation and pollution (Gerlach 2008a, Gerlach & Canning 2001, Pawlowski & Krämer 2006). For this reason, both freshwater turtle subspecies are considered as "Critically Endangered" (Gerlach & Canning 2001). As a consequence they are included in the NPTS breeding program in order to stabilise populations by the release of juveniles back into the wild (Gerlach 1997, 2002b, 2006, 2008b). Whereas the reproductive rate of the black mud turtle is considered to be good, the breeding success in the second species is low (Pawlowski & Krämer 2010a). Within the central islands only a few sites for the Yellow bellied mud turtle are left more or less undisturbed: The rivers at Anse Intendance on Mahé and the river Mare Soupape on La Digue (Gerlach 2000). The main former habitat on Praslin (Anse Kerlan marsh land), however, seems to be lost forever at least for the Yellow bellied mud turtle due to the construction of a large golf course (Gerlach 2008a, Gerlach & Canning 2001).

During several excursions on La Digue island in December 2004, 2007 and 2008 distribution and the activity pattern of the Yellow bellied mud turtle were

investigated. Furthermore, a second previously unknown, population of this turtle species was found on this island in 2007 (see also Gerlach 2000, 2002a, Gerlach & Canning 2001, Pawlowski & Krämer 2006).

Results

Observations on La Digue

The distribution and activity pattern of the yellow bellied mud turtle on La Digue were observed at various times during the day ranging from early morning (about 8:00 a.m.) until evening (about 6:30 p.m.) at the river Mare Soupape and its tributaries and at the water locations at the Grand Anse. The rivers La Passe, Laporte and La Source Marron along with the water bodies at Anse Cocos were not recently investigated. All observations were made by sight only.

During the time period from December 11-14th, 2007, air temperature was measured using a digital thermometer (Amadigit ad 15 th; -40 – 120 ± 0.1 °C) and weather conditions were also recorded visually.

Actual water situation

The mountains of La Digue which are more or less arranged in south-north direction, separate the island into a broader western and a smaller eastern lowland area. Due to its height of up 333 m (Mont La Digue) rain clouds tend to stick to this mountains releasing their water into the forests along these hills, this being the source of small and medium sized rivers at the west and east sides respectively (Fig. 1). The Mare Soupape with a total length of about 2 km and its tributaries in the western lowland is the biggest river on the island and is known to support a population of the Yellow bellied mud turtle (Gerlach & Canning 2001, Pawlowski & Krämer 2006). The rivers La Passe and Laporte are, in contrast, rather small and do not contain any populations of freshwater turtles to our recent knowledge. However, at the south-east side along Grand Anse, Petit Anse and Anse Cocos a few small rivers formed several fairly large water areas. These were at least partly covered by either Hyacinths *Eichhornia* sp. or Water lettuce *Pistia stratoites*, invasive aquatic plant species growing on the water surface which resulting in shading of the water bodies (Gerlach 2000, Pawlowski & Krämer 2006, 2008).

As all rivers on La Digue are fed by the rain water from the mountain side, the water level in the rivers and ponds are strongly correlated to the dry (April to September) and wet seasons (November to February). However, as the 2008 dry season was very intense in the inner granitic Seychelles islands (including La Digue) river water levels on La Digue dropped dramatically until the end of 2008. In fact, water level at the Mare Soupape and at the river and ponds at the east side were about 1 to 2 m below the levels observed in the years before (2004 and 2007). As a consequence, almost all tributaries of the Mare Soupape and the small rivers La Passe and Laporte at the west side were dried out (Fig 1). In addition, the ponds at the eastside (i.e. at Grand Anse) also almost dried out, so that only small water areas of less than 100 m^2 were remaining (see also satellite pictures at Google-Earth in 2009). However, the status of the river La Source Marron by the end of 2008 remains unclear as it cannot be reached from the land on a regularly travelled route.

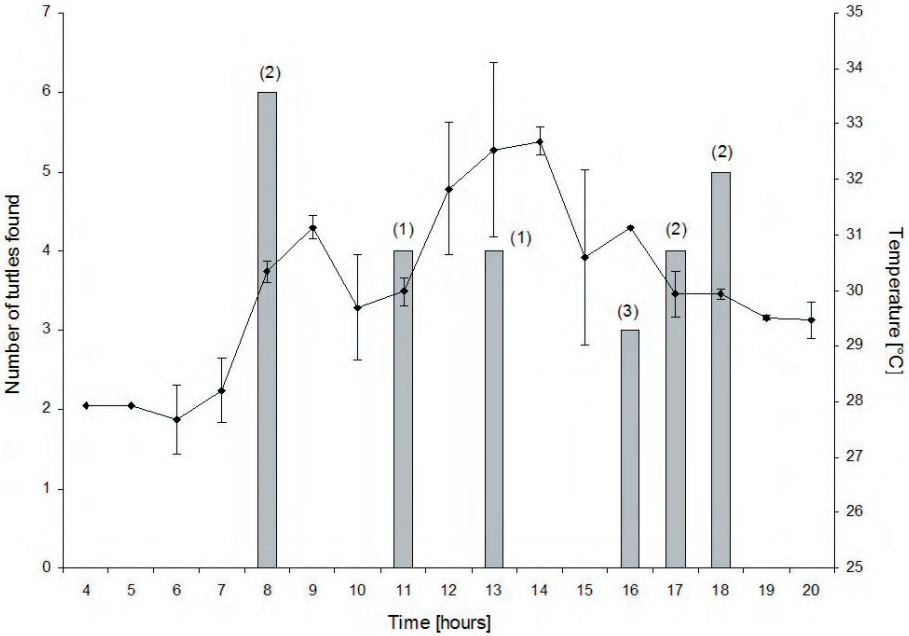

Fig. 1. Activity pattern of adult Yellow bellied mud turtles *Pelusios castanoides intergularis* and corresponding air temperatures (December 2007) on La Digue. Number of observations in brackets.

Observed populations

All turtles observed were adults, no semiadults (5 to < 10 cm carapace length; see Gerlach 2002b for details) or juveniles (approximately 3 to 5 cm carapace length) were detected at either site. At the river Mare Soupape Yellow bellied mud turtles could be observed at various sites of the main river itself and also in its tributaries in December 2004, 2007 and September 2008 (by Sauberer, Fig. 2). In November 2008, no freshwater turtles could be found on La Digue at all by Hofrichter (pers. communication 2009). In December 2008, no turtles could be found along the river Mare Soupape at low water level (approximately 1 m below normal level). The number of turtles found were generally low (1 to 2 specimens with 100 to 200 m) distance, however, at specific sites (feeding places) some sort of agglomeration of turtles took place, were up to 4 or 5 individuals came together (Table 1).

Although the river Mare Soupape was investigated at various times of the day most of the turtles were found active either in the morning or the late afternoon (Fig. 2). During the daytime adults were only found at the shady areas of the Mare Soupape but in the late afternoon, turtles were also located at the non-shaded areas of the river. Only one observation in 2004 shows an activity of these animals in the early afternoon (approximately 1:00 p.m.), however, weather conditions were rather worse in the morning (heavy rain), whereas sunny weather was present at all other observation time periods.

Fig. 2. Water levels and investigated sites (1 – 7) of Yellow bellied mud turtles *Pelusios castanoides intergularis* at La Digue. Left – normal water level; right – water level by the end of 2008 (end of dry season); blue – rivers and other water bodies; red – main roads

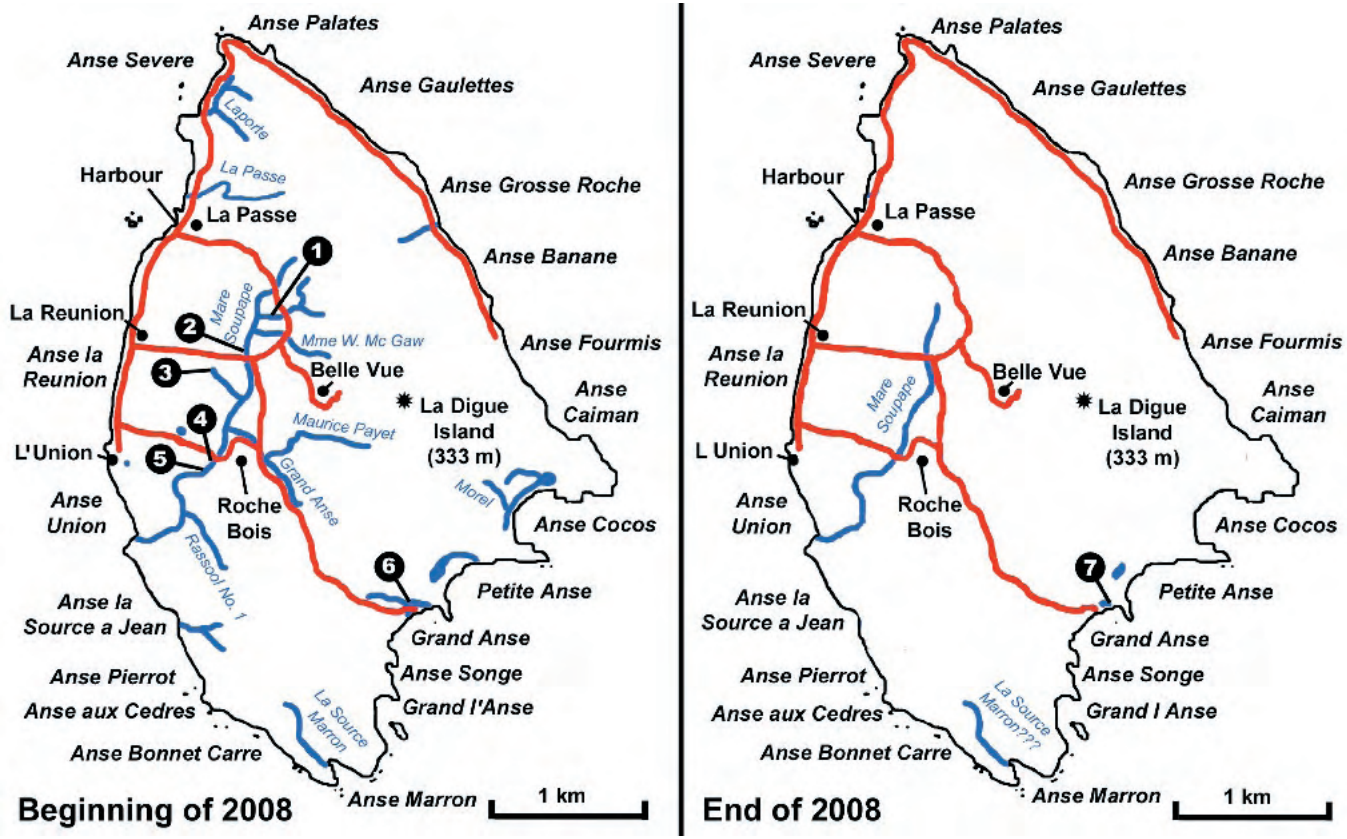

Table 1. Number of observed Yellow bellied mud turtles *Pelusios castanoides intergularis* Bour, 1983 at La Digue

Locality	Date	Approximate time	Number of animals	Site[1]	Comments
Mare Soupape	09.12.04	1:00 p.m.	≥ 4 (adults)	4	Only found at the shady side of the river; however, rain was falling during the morning hours
	11.12.07	4:00 p.m.	1 (adults)	3	Sunny weather
	11.12.07	5:30 p.m.	3 (adults)	5	Sunny weather
	12.12.07	8:00 a.m.	1 (adults)	2	Sunny weather; animals were fed for better visibility
	12.12.07	5:30 p.m.	2 (adults)	4, 5	Sunny weather
	13.12.07	4:00 p.m.	1 (adults)	2	Sunny weather; animals were fed for better visibility
	13.12.07	8:00 a.m.	5 (adults)	2	Sunny weather; animals were fed for better visibility
	14.12.07	11:00 p.m.	4 (adults)	2	Sunny weather; animals were fed for better visibility
	23.09.08	7:00 a.m.[2]	1 (adults)	1	Sunny weather, low water level
	Dec. 08	Various times	0	2 – 5	Sunny weather; low water level
Grand Anse	09.12.04	3:00 p.m.	0	6, 7	Sunny weather in the afternoon; normal water level
	14.12.07	4:00 p.m.	1 (adults)	6	Sunny weather; normal water level
	01-05.12 08	Various times	0	6	Sunny weather; no water remaining
	01.12.08	5:00 p.m.	2 (adults)	7	Sunny weather; less remaining water
	03.12.08	5:00 p.m.	2 (adults)	7	Sunny weather; less remaining water

[1]See Fig. 1 for further details; [2]Observations by Sauberer 2008, pers. comm. 2008.

At Grand Anse, less time was spent observing the water bodies in 2004, recording no turtles at about 3:00 p.m. In contrast, one adult turtle was found at the surface water level at site 7 but disappeared within at short time after its discovery back into the depth of the water. As water levels at Grand Anse dropped dramatically until December 2008, most of the water had already disappeared (probably since summer 2008, as a number of terrestrial plants were already growing in the upper river level). At the low end of the river, only a small water reservoir of about 10 m^2 surface and maximum about 50 cm depth was remaining. No turtles were found during the daytime however, two individuals were present and active at the late afternoon (about 5 to 6:30 p.m.) on several days of observations.

Discussion

The endemic Yellow bellied mud turtle *Pelusios castanoides intergularis* on La Digue is mainly found at the river Mare Soupape and its tributaries along the west side of the island. As several individuals were observed at the water bodies along the Grand Anse (east coast) it can be concluded that there is a second independent population of

that species living on this island. This is in contrast to previous studies, where only few individuals of Black mud turtles *Pelusios subniger parietalis* could be found here (Gerlach 2002b, Gerlach & Canning 2001). On the other hand, the latter species could not be found on La Digue at any time of our investigations.

As the west side of La Digue is rather flat, it is very likely that the freshwater turtles move via muddy or terrestrial areas in order to find new water bodies, especially at times of low water levels within the dry season (Sauberer 2008, pers. comm..; Gerlach 2002b). The water bodies at Grand Anse are embedded in a mountain scenario (up to approx. 200 m), which are rather unlikely to be crossed by turtles coming from the west side of the island.

The distribution pattern of *Pelusios castanoides intergularis* fits mainly with the previous investigations on La Digue and on the other central islands of the Seychelles (more or less shady areas of lowlands rivers and ponds), however, depending on the daytime and weather conditions turtles can be found also at non-shady areas of both the Mare Soupape and at the Grand Anse. Mashes directly connected to the sea contain at least temporarily brackish or pure salt water, are not inhabited by this species.

Overall, under sunny weather conditions turtles were active within the morning or the late afternoon hours only. Similar to the terrestrial Aldabran tortoises *Dipsochelys dussumieri* Gray, 1831, activity pattern changes during daily rain periods (Coe & Swingland 1984, Pawlowski 2008, 2009a, Pawlowski & Krämer 2005a, b).

Actual investigations on the river water situations on La Digue displayed a dramatic drop of the water levels at the Mare Soupape and a loss of water areas and bodies, respectively, which indeed restrict the possible habitat of both *Pelusios castanoides intergularis* and *Pelusios subniger parietalis* to small areas at both the west and the eastside of the island by the end of December 2008. Within the recent discussion on the climatic change and their possible impact on the fresh water turtle situation, it is unlikely that temporarily dry periods will affect the freshwater turtle populations at the Seychelles in the end (i.e. on La Digue), as turtles of the genus *Pelusios* are either able to walk over land to reach new water bodies (Sauberer 2008, Bombi *et al.* 2009, Gerlach 2002b) or being able to rest in the mud for up to several months (Grychta 1999). Furthermore, dry periods or periods of low rain fall also occurred in the past on these islands at regular intervals (see also Gerlach & Canning 2001, Walsh 1984). Observations on captive individuals of both freshwater turtle species indicates that they at least temporarily spend their time hiding in the soil close to the water bodies (Pawlowski 2009b, Pawlowski & Krämer 2006, 2008, 2010a). A similar resting behaviour can also be observed for the North American Diamondback terrapins *Malaclemys terrapin terrapin* Schoepff 1793 and *M. t. centrata* Latreille 1801, a species being restricted to the brackish waters along the east coast (Brennessel 2006, Pawlowski & Krämer 2010b). However, if the low water levels do not be rise back to the normal levels within the wet season, some of the habitats might be lost forever within the following dry season (Spring 2009). Overall, low water levels at the beginning of a new dry period along with an increase in human water consumption due to both population and tourist growth on La Digue will minimise the remaining water resources on this and the other central Seychelles islands like Mahé and Praslin (Pawlowski 2009b,

Pawlowski & Krämer 2009). Thus, sufficient amounts of freshwater might become one of the major issues for this island and subsequently for the freshwater turtles in the future (besides all the other aspects of habitat destruction and pollution). As juveniles or semiadults were either rarely found or totally absent, and as possible nesting sites are still unknown, the threat of an aging population on La Digue, as well as on other central islands, indicates an urgent need for further investigations and conservation. There is no doubt that habitat destruction and pollution due to the increase in urbanisation and cultivation of landscapes are the main reasons for the population decrease in the past decades (Gerlach 2000, Gerlach & Canning 2001, Pawlowski 2009b, Pawlowski & Krämer 2006, 2008). In addition, the introduction of alien land predators such as dogs, cats, rats, tenrecs and possibly Tilapias *Sarotherodon mossambicus* Peters, 1852 (a threat for hatchlings) might contribute to the decline in reproductive success (Gerlach 2002b, Nussbaum 1984). As nesting sites are likely to be located along the rivers, an increase in human wastes and discharges along the rivers will also increase the number of various mangrove crab species, which are known to be a major threat for juvenile turtles (Brennessel 2006, own observations).

Conclusion

Overall, it can be concluded that the population on La Digue is threatened by various causes, which are mainly linked to the urbanisation of the island. Whilst a temporary dry period will not affect the population of freshwater turtles, an extension of habitat loss due to long lasting dry periods together with anthropogenic habitat destruction and pollution will indeed have a deep impact on the future of the fresh-water turtle populations. As a consequence, a rescue plan for this species needs improvement in many levels such as establishment of water saving and cleaning processes (water treatment plants), waste disposal management and of course a better environmental conservation education in order to safe the last remaining habitats of *Pelusios castanoides intergularis* on La Digue and also on the other central islands

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